south river
SCIENCE TEAM

Ecological Study Phase II Conceptual Plans

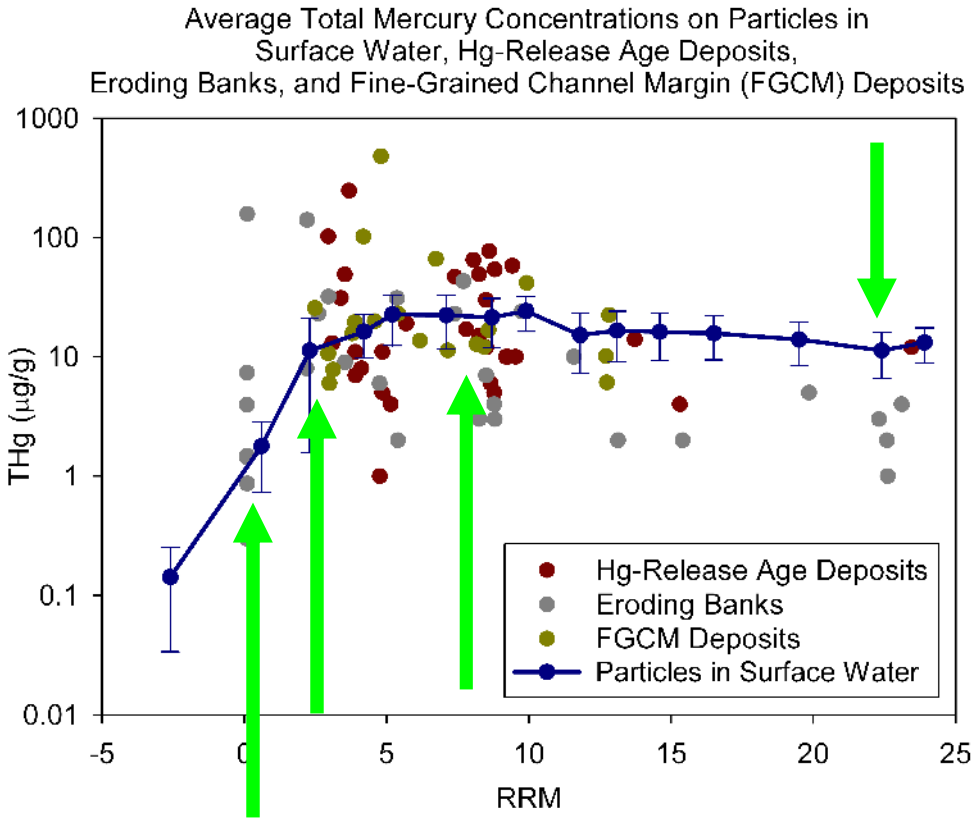
January 21, 2009

URS

Understanding River Physical and Biological Loading Processes along this Continuum

Preliminary Phase II Study Locations Selection:

- Located in areas that allow safe work access to the river
- Corresponding with river-bank floodplain features (HRADs and LiDAR stations) and areas with FGCM deposits
- Located proximal to previous data collections including food web study; integrated with ongoing SRST studies
- Located along South River Study Area including adjacent to pilot river-bank erosion control site
- Focus on evaluating physical and biological loading in zones of surface water hydraulic storage and transport



Preliminary Phase II Study Areas for Initial Characterization

Area	Feature Type[1] and Number	Approx. RRM	Bank	Maximum [THg] (ppm)	Vertically Averaged [THg] (ppm)	Maximum Depth of Samples (cm)	FGCM Deposit Present	FGCM Deposit Present
1	PILOT AREA	0.1	Right	584	25	485	--	Limited
2	HRAD 1	3.0	Right	432	102	165	105-135	Yes
	LIDAR 005	3.0	Left	110	43	185	15-45	
3	HRAD 5	3.5	Left	204	49	165	135-165	Yes; feature is buried FGCM Deposit
	LIDAR 004	3.5	Right	29	9	135	15-45	
4	HRAD 6	3.7	Left	839	247	190	105-135	Yes
5	HRAD 17A	8.3	Right	18	15	105	45-75	Yes
	HRAD 17B	8.3	Right	196	49	135	15-45	
	LIDAR 009	8.3	Left	8	3	150	0-15	
6	HRAD 20	8.5	Right	27	12	65	0-15	Yes
	LIDAR 010	8.5	--	26	7	135	15-45	
	HRAD 21	8.6	Right	163	77	135	45-75	
7	HRAD 18	8.8	Left	144	54	100	75-100	Yes
	LIDAR 012	8.8	Right	16	3	165	15-45	
8	LIDAR 022	23.1	Right	13	4	90	0-15	Limited
	HRAD 39	23.1	Left	2	0	45	0-15	

Notes:

[1]Feature Types:

PILOT AREA: Location of pilot study evaluating river bank erosion control.

LIDAR: Refers to river bank measured using LIDAR (Light Detection and Ranging), optical remote sensing technology that uses scattered light, to determine short term eroison rates.

HRAD: A Hg-Release Age Deposit

RRM: Relative River Mile

THg: Total Mercury

[THg]: THg Concentration

ppm: part per million

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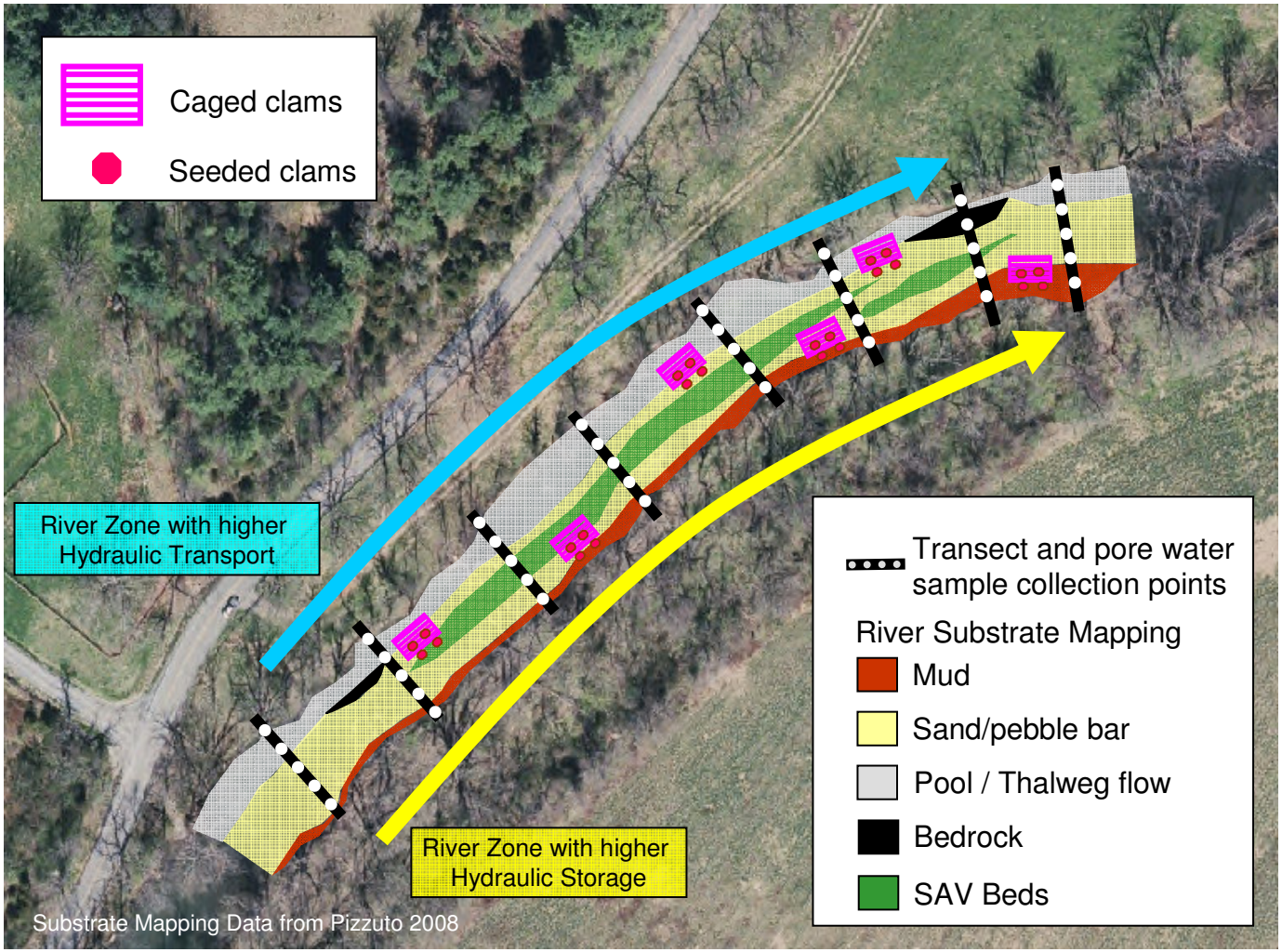
Physical and Biological Loading Mechanisms

Objectives

- Characterize physical loading processes for THg, MeHg and IHg from various river compartments
- Evaluate linkage between IHg and MeHg concentrations in physical media (soil, sediment, surface water), primary producers (periphyton), and first order aquatic consumers
- Develop a baseline physical and biological data set at prospective sites conducive to testing potential remedial options targeted to address mercury loading mechanisms

Integrated Sampling Approach
Example Phase II Study Location (RRM 2.95)



Physical Loading Study Approach

Goal is to calculate IHg and MeHg mass transfer from substrates found in the South River:

- FGCM deposits and other fine-grained sediment types
- Sand/pebble/gravel beds
- Cobble/boulder areas

Sampling will focus on collecting data

- Close-interval measurement of near-surface pore water samples
- Water column driving force
- Reach load
- Advection rates

Physical Loading Sampling Collection and Timing

At each transect:

- Channel morphology survey
  - Velocity/discharge measures
  - Substrate characterization
  - Hydraulic head measurement
- 5 porewater samples collected for THg and MeHg
  - 10% of samples collected at depth

Four events in 2009:

- May
- July
- October
- Post-storm event (TBD)
- October and post-storm event to focus on THg

Sample Collection and Analysis Techniques

Porewater samples will be collected using Henry probes

- Samples will be filtered and analyzed for THg and MeHg
- Collection will target the top 5 cm
- Subset of locations will be sampled at depth

Benthic Flux Chambers

- Chambers will be used to measure IHg and MeHg fluxes and advection rates

Bioreporter

- Technique will be used to determine relative amount of bioavailable IHg in a porewater sample or solid phase extraction sample

DGT (Diffusive Gradients in Thin films)

- May be used to provide higher resolution depth profiles of THg in porewater

Biological Loading Study Approach and Timing

- Evaluate caged clams and seeded clams to determine biological loading rates for two feeding guilds (filter feeding and filter feeding / sediment gathering)
- Sample during Spring and Summer and integrate with physical loading work
- Use combination of previously established clam transplant methods and seedings

Jenkins and Burkhead (1994)

Biological Loading Study Approach and Timing (Continued)

- Co-locate caged and seeded clams at six sampling stations within the Phase II study sites; three stations in hydraulic storage zones and three stations in hydraulic transport zones
- Harvest three replicate composite samples at 1, 3, and 5 weeks following transplant for THg and MeHg analyses
- Monitor ambient concentrations in sediment, surface water, and periphyton during sample collection

Caged clams from Benzing and Neufeld SRST presentation October 21, 2003

Biological Monitoring of THg in Bass Tissue

Objective

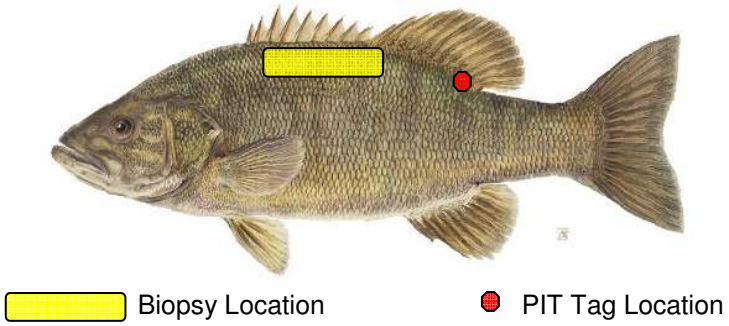
Track and evaluate seasonal and inter-annual changes in THg concentrations in the muscle tissue of smallmouth and largemouth bass

Study Locations / Timing

- Study locations may include Constitution Park (RRM 0.1), Augusta Forestry Center (RRM 11.8), and Grottoes Town Park (RRM 19.5)
- Two monitoring events will be conducted in Spring and late Summer / Fall

Bass Tissue Collection Methods

- Electrofishing along targeted river reaches
- Use dermal biopsy methods for non-lethal tissue collection



- Tag bass with passive integrated transponder (PIT) tags for unique identification and tracking of sample population
- Integrate study with VADEQ program in future to validate biopsy results with fillet results (look into 2007 archived fillets for initial data)

Monitoring Framework

Study Design

- Initial sampling event in May 2009:
  - Tag and collect baseline tissue for THg analysis in up to 20 bass collected in three size ranges [smallmouth bass from: 104-166 mm, 167-215 mm and greater then 216 mm; size classes adapted from Murphy (2004)]
  - Archive additional samples if collected
  - Take length, weight, and scales (removed as part of the biopsy process)
- Subsequent sampling events:
  - Collect baseline tissue for THg analysis in up to 10 recapture bass from three size ranges
  - Tag and collect baseline tissue for new captures
  - Take length, weight, and scales

Timeline and Sequencing of Studies

Item	2009												2010		
	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			1st Quarter		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
Workplan Development															
Study Preparations															
Preliminary Study Site Selection															
Field Habitat Survey															
Soil and Sediment Characterization															
Final Phase II Study Area Selection															
Physical and Biological Loading Study															
Data Evaluation															
Baseline Monitoring															
Surface Water															
Bass Tissue															
Triad Study Planning															